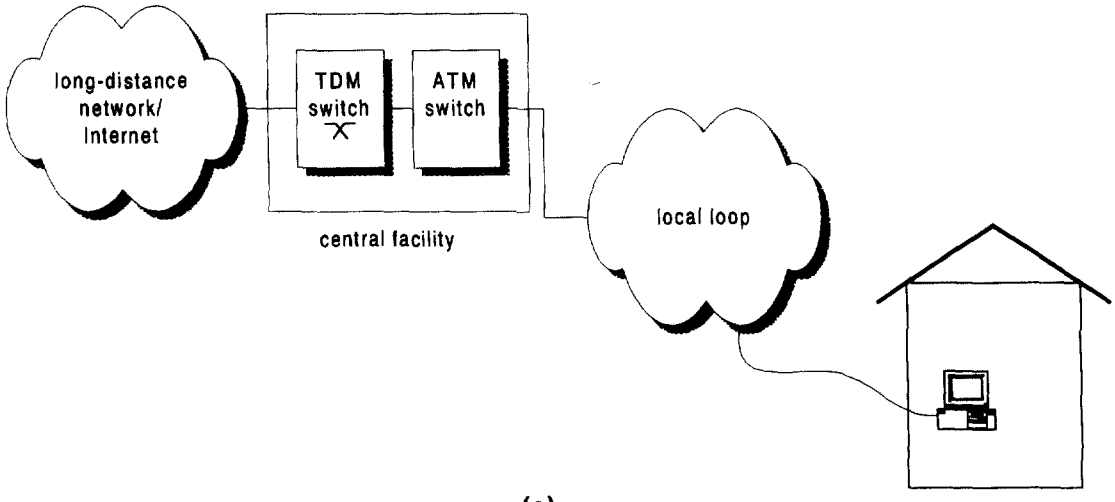
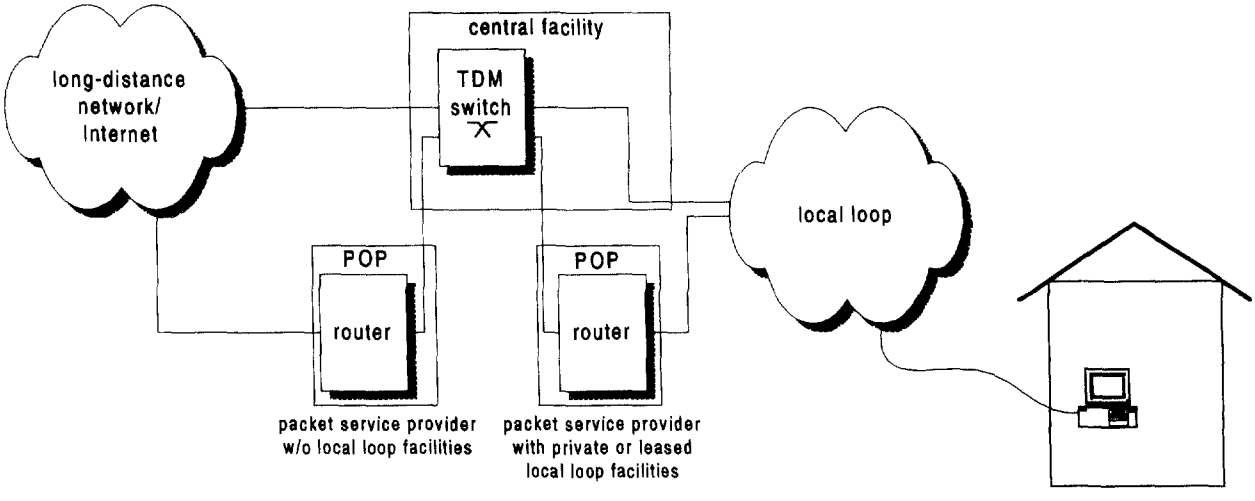


(a)



(b)

Figure 3. Local loop packet based transport architectures including (a) use of a circuit (Time Division Multiplex) switch at the network side of the packet based transport; and (b) delivery of packet based services over separate or leased facilities.

Interconnection and Unbundling in a Broadband Environment

Because circuit switched local loop services will co-exist with emerging packet services for a considerable time period, it is necessary to consider how the regulated circuit switched infrastructure can be unbundled and interconnected to meet the Section 251 requirements of the Act.[180]

Fig. 4(a) illustrates the simplest case where loops are unbundled, and POTs services reside on loops adjacent to some form of Digital Subscriber Loop (xDSL) transmission. Many xDSL transmission technologies were developed to be POTs compatible, and thus present no significant problems with respect to having high-speed digital signals in the same bundle of wires as an analog voice signal. Additionally, all DSL technologies were developed to permit multiple pairs to transmit digital signals without interfering with each other- this in fact is the principal challenge in DSL system design. The conclusion is that DSL technologies are compatible with POTs signals, and DSL signals are by design compatible with other DSL signals in a bundle,[181] so and unbundling of the pairs presents no technological difficulties.

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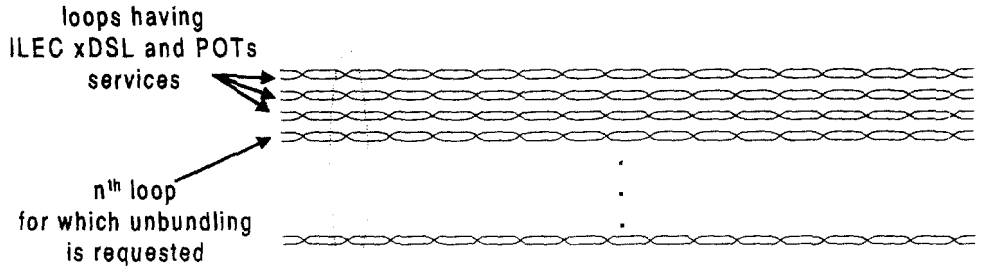
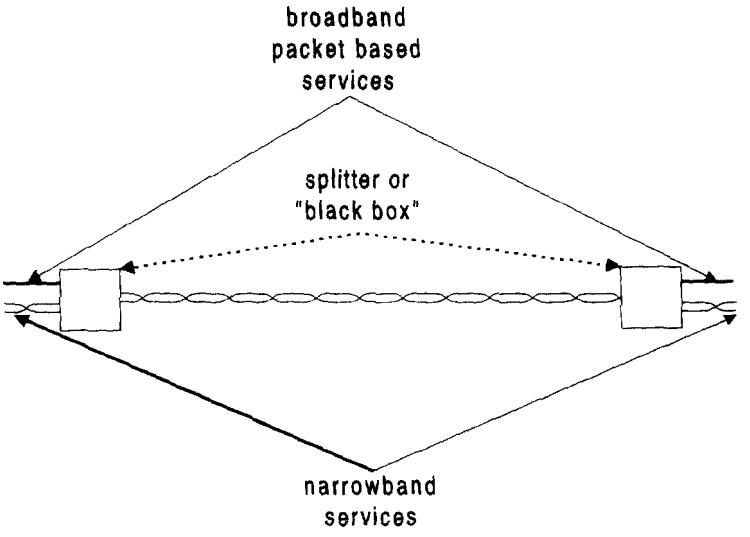
[180] 47 U.S.C. 251

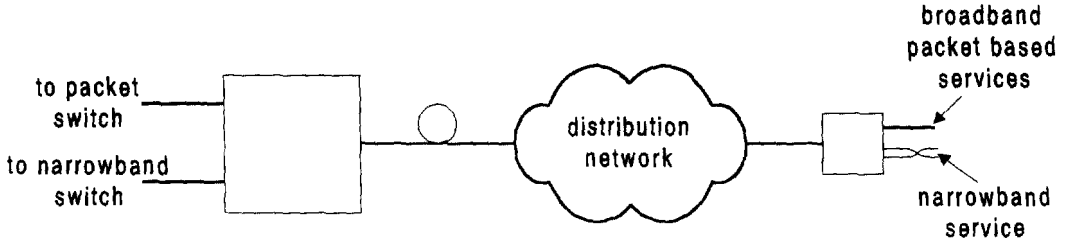
[181] For unbundled loops where competitors (typically entrants and incumbents) are simultaneously DSL technologies



(a)



(b)



(c)

Figure 4. Unbundling and interconnection for narrowband services based on (a) loop unbundling; (b) narrowband service unbundling; and (c) narrowband service unbundling in an integrated transport system.

Fig. 4(b) illustrates the case in which a twisted wire pair path is used to provide both narrowband services (typically analog POTs) as well as broadband packet services. In this case splitters (separation filters) are used at both ends to separate the packet based broadband signals from the narrowband signals. There are newer "splitterless" technologies which do not require a physical splitter, but in any case the ability to separate the services is clear.

Finally, Fig. 4(c) illustrates the case in which an integrated transport system is used which carries the circuit switched and packet based services over unified platform: there are numerous examples of such systems including Fiber-to-the-Curb (FTTC) and Fiber-to-the-Home (FTTH) systems, as well as the Hybrid Fiber Coaxial (HFC) systems used by cable operators. In these systems, the circuit switched data may be carried within packets or cells directly from the central office or head-end to the residence. For traditional POTs services, the circuit switched signal is reconstructed at or near the residence, and an analog telephone signal is presented at an interface (e.g. RJ-11 jack). Similarly, the circuit switched information is made available at the network side in either digital or analog form. From a technical perspective, there are no problems related to the removal of the circuit switched information from the packet based services at either end of the network.

Cost Allocation

One of the most complex and perhaps most ominous barrier to broadband deployment is the issue of cost allocation and what is perceived by many as the "necessity to avoid cross-subsidization of new broadband services by regulated services." Upon closer examination it appears that most of the arguments forwarded in this area are related to fears regarding the dominant role incumbent LECs would play in the broadband services market. While these fears are certainly not unfounded,

it is important to note that building new, high penetration wired broadband networks may have economies of scale and scope which requires significant investment for these new services, at least in the short term, until penetration rates are significant and the demand (and correspondingly the price) results in significant intermodal competition. If significant penetration rates are achieved, the demand for bandwidth will be stimulated to the extent that other facility based competitors can enter the market and stable competition can exist.

The ability to move forward on broadband deployment and resolve the issue on cost allocation is dependent on establishing pure price cap methodologies for narrowband services, both at the federal and state levels. On one hand, the move towards price cap regulation at both levels is already taking place, and the adoption of price cap models for long distance service by the Commission, and for local exchange service by many of the states, is encouraging.[182] On the other hand, the contentious issue of cross-subsidization of video services by regulated narrowband services has been addressed but never resolved by the Commission.[183] The initial proposals to trigger decreases in price cap indices based on "exogenous" changes such as the offering of video programming or other unregulated activities[184] would create a huge disincentive for the deployment of broadband infrastructure and completely undermine the logic behind price cap regulation.

Even for traditional narrowband services cost allocation issues are almost impossible to resolve.[185] In the face of rapid technological change and the growing demand for bandwidth, it will

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[182] For a discussion of pricing regulation and the move towards price caps see R.W. Crandall and L. Waverman, *Talk is Cheap* (Brookings Institution, Washington D.C., 1995).

[183] CC Docket No. 96-112, *Allocation of Costs Associated with Local Exchange Carrier Provision of Video Programming Services*, was released on May 10, 1996 and raised cost allocation issues with respect to Open Video Systems, but no rulemaking has taken place to date.

[184] *Id.* paras. 58-60.

[185] As an example, with respect to allocation rules for apportioning the common fixed costs of service between different

be an impossible task to adequately monitor and separate broadband and narrowband service costs and determine prices. By adopting pure price cap methodologies for narrowband circuit switched services and allowing packet based broadband services to be deployed on an truly unregulated basis (e.g. no exogenous adjustments) it will be possible to achieve significant penetration rates for new services. Achieving significant degrees of penetration will result in market sizes which will result in competition, and prevent long term natural monopoly situations from existing.

Conclusions

The proposal offered here attempts to illustrate that there are fundamental differences between the existing circuit switched telephone network and emerging broadband packet based services. These differences can be used to establish a barrier between regulated narrowband services and new broadband services which will need to remain unregulated in order to foster private investment in network infrastructure and establish significant penetration rates for these new services.

The issues of unbundling of narrowband network elements to comply with the Telecommunications Act of 1996 in scenarios where packet based and circuit switched services are carried over the same network elements are complex. Nevertheless, there exists the ability to separate the services at the end points (subscriber location and central office or point-of-presence). This will permit further deregulation of the narrowband network without burdening the packet based network with regulation.

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classes of customers, most economists agree that "common costs cannot be uniquely and nonarbitrarily allocated among customers and that the average costs that result from such an apportionment procedure, based on historical costs, are likely to result in incorrect prices (*Id.* p. 103).

Finally, the issue of cost allocation is addressed. A movement to pure price cap methodologies for narrowband services, both at the state and federal levels, is essential to permit deployment of broadband networks

APPENDIX B: DIGITAL BROADBAND WORKING GROUP BRIEFING ATTENDEES

Maggie Barrington		US WEST, Advanced Technologies
Thomas Barry	Senior Vice President, Federal Relations	SBC Communications, Inc.
Marc Berejka	Federal Regulator Affairs Manager	Microsoft
Robert Blau	Vice President of Executive & Federal Regulatory	BellSouth
Debra Brunton	State Affairs Representative	Microsoft
Philip Burgess	President and Chief Executive Officer	Center for the New West
Jeffrey Campbell	Manager, Federal Government Affairs	Compaq
Dave Charlton	Business Development Manager	Corning
John Charters	Vice President, Internet Services & Application Development	U S WEST Communications
Larry Clinton	Assoc. Vice President of Large Company Affairs	USTA
Scott Cooper	Government Affairs Manager	Hewlett-Packard
Ophyll D'Costa	Executive Director, Strategic Development	U S WEST Communications
David Dorman	Chief Executive Officer	PointCast, Inc.
Jeffrey Eisenach	President	The Progress & Freedom Foundation
Charles Eldering	President	Telecom Partners Ltd.
Robert Frankenberg	President and Chief Executive Officer	Encanto Networks, Inc.
Paul Fuglie	Assistant Vice President, Regulatory	GTE Corporation
Dick Green	President & Chief Executive Officer	Cablelabs
Don Gips	Chief Domestic Policy Advisor	The Office of the Vice President
Dennis Glaves	Assistant Vice President, Congressional Affairs	GTE Corporation
Gita Gopal	Department Manager, H-P Labs	Hewlett-Packard
Rob Griffen	Regulatory Counsel, Information Services Group	Bell Atlantic
Mike Grubbs	Director, Convergence Products	Gateway 2000
Tim Hackman	Director of Public Affairs	IBM
Christine Hemrick	Vice President/General Manager, Internet Appliances and Applications Business Unit	Cisco Systems, Inc.
Tony Hennon	Senior Vice President	Motorola
Grace Hinchman	Manager, Public Affairs	Digital Equipment Corporation
Link Hoewing	Director, Issues Analysis	Bell Atlantic
Laura Ipsen	Manager, Government Affairs	Cisco Systems, Inc.
Ted Jenkins	Vice President & Director of Corporate Licensing	Intel
George A. (Jay) Keyworth	Chairman	The Progress & Freedom Foundation
Robert Kirkwood	Director of Government Affairs	Hewlett-Packard
Kal Krishnan	Sr. Vice President & Chief Technology Officer	Encanto Networks, Inc.
David Krone	Vice President of Government Relations	TCI, Inc.
Mary McManus	Director of Federal Public Affairs	Lucent Technologies
Donald McClellan	Senior Fellow	The Progress & Freedom Foundation
Garland McCoy	Vice President for Development	The Progress & Freedom Foundation
Jill Murphy	Director of Communications	The Progress & Freedom Foundation
Alex Netchvolodoff	Vice President for Public Policy	Cox Enterprises, Inc.
Donna Northington		US WEST, Advanced Technologies

Michele Obermeier		US WEST, Advanced Technologies
Robert Pepper	Chief, Office of Plans and Policy	Federal Communications Commission
Jeffrey Peters	Vice President, Digital & Applied Imaging	Eastman Kodak
Mike Pettit	Counsel	Spence, Fane, Britt & Browne
Lewis Platt	Chief Executive Officer	Hewlett-Packard
David Porter	Vice President Government Affairs	WorldCom
Bruce Posey	Vice President, Federal Relations	U S WEST Communications
Tim Regan	Vice President & Director, Federal Government Affairs	Corning, Inc.
John Robinson	Vice President, Strategic Planning	BellSouth
Daniel Scheinman	Vice President, Legal & Government Affairs	Cisco Systems, Inc.
Paul Shumate	Executive Director of Broadband Local Access	Bellcore
Michael Schwartz	Senior Vice President, Communications	CableLabs
Steven Stewart	Program Manager, Telecommunications Policy, Government Programs	IBM
Tim Stone	Vice President, Business Development	Motorola
Raymond Strassburger	Director, Government Relations-Telecommunications Policy	Northern Telecom
Lynn Streeter		US WEST, Advanced Technologies
Howard Symons	Partner	Mintz, Levin, Cohn, Ferris, Glovsky & Popeo, P.C.
Thomas Tauke	Senior Vice President, Gov. Relations	Bell Atlantic
Solomon Trujillo	President & Chief Executive Officer	U S WEST Communications
Jan Wadsworth	West Coast Counsel	America Online
Timothy Waters	Vice President, Data Product Management	Ameritech
Thomas Wheeler	President and Chief Executive Officer	CTIA
Bud Wonsiewicz	President	US WEST, Advanced Technologies
Joseph Zell	President, !NTERPRISE Networking Services	U S WEST Communications